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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re U.S. Patent Application of

ISOBE et al.

Application Number: 10/808,364

Filed: March 25, 2004

**For: METHOD FOR MANAGING DISK DRIVES OF
DIFFERENT TYPES IN DISK ARRAY**

Attorney Docket No. HITA.0532

**Honorable Assistant Commissioner
for Patents
Washington, D.C. 20231**

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) **Art Unit 2188**
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PETITION TO MAKE SPECIAL UNDER 37 C.F.R. § 1.102(d)
FOR ACCELERATED EXAMINATION

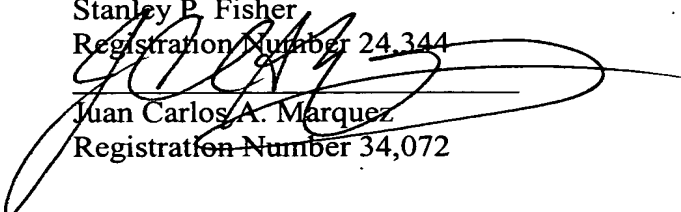
Sir:

Pursuant to 37 C.F.R. § 1.102(d), Applicants respectively request that the application to be examined on the merits in conjunction with the pre-examination search results, the detailed discussion of the relevance of the results and amendments as filed concurrently.

Substantive consideration of the claims is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the above-captioned application, the Examiner is invited to contact the Applicants' undersigned representative at the address and telephone number indicated below.

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STATEMENTS & PRE-EXAMINATION SEARCH REPORT
SUPPLEMENTAL TO
THE PETITION TO MAKE SPECIAL

Sir:

Pursuant to 37 C.F.R. §§ 1.102 and MPEP 708.02 VIII, Applicants hereby submit that (1) all claims of record are directed to a single invention, or if the Office determines that all the claims presented are not obviously directed to a single invention, will make an election without traverse as a prerequisite to the grant of special status; (2) a pre-examination search has been conducted according to the following field of search; (3) copies of each reference deemed most closely related to the subject matter encompassed by the claims are enclosed; and (4) a detailed discussion of the references pointing out how the claimed subject matter is patentable over the references is also enclosed herewith.

FIELD OF THE SEARCH

The field of search covered the following classes:

<u>Class</u>	<u>Subclasses</u>	<u>Description</u>
710/		ELECTRICAL COMPUTERS AND DIGITAL DATA PROCESSING SYSTEMS: INPUT/OUTPUT

<u>Class</u>	<u>Subclasses</u>	<u>Description</u>
	10	.. Configuration initialization
	15	. Peripheral monitoring
	16	.. Characteristic discrimination
711/		ELECTRICAL COMPUTERS AND DIGITAL PROCESSING SYSTEMS: MEMORY
	114 Arrayed (e.g., RAIDs)
	162	... Backup

The above subclasses represent areas deemed to contain subject matter of interest to one or more of the search features. Please note that relevant references may be classified outside of these areas. The integrity of the search is based on the records as presented to us by the United States Patent and Trademark Office (USPTO). No further integrity studies were performed. Also a key word search was performed on the USPTO full-text database including published U.S. patent applications.

The search was directed claims 1-22 of U.S. Application 10/808,364. The claims as generally characterized by a disk array device, comprising: a disk array device enclosure; a plurality of disk drives stored in the disk array device enclosure; a controller which controls the reading and writing of data from and to the disk drives; and a fiber channel cable connecting the disk drives and the controller, wherein: the disk drives include two types of disk drive, which are a fiber channel disk drive with a fiber channel interface, and a serial disk drive with a serial interface; the serial disk drive is connected to the fiber channel cable via an interface connection device that converts the serial interface to a fiber channel interface; and the controller discriminates the type of each of the disk drives by communicating via the fiber channel cable.

LIST OF RELEVANT REFERENCES

The search revealed the following U.S. patents or applications, which are listed for convenience:

<u>U.S. Patent No.</u>	<u>Inventor</u>
5,617,425	Anderson
6,829,658	Beauchamp et al.

<u>U.S. Patent Application Publication No.</u>	<u>Inventor</u>
2004/0162940 A1	Yagisawa et al.
2005/0071525 A1	Yagisawa et al.

Discussion of References:

U.S. Patent No. 5,617,425 to **Anderson** assigned to Seagate Technology, Inc. is entitled *Disc Array Having Array Supporting Controllers and Interface*. **Anderson**'s disc drive array 21 (Figs. 2 & 4; col. 6, line 67 to col. 7, line 3) includes a host computer 22, a plurality of array controllers 24, 26, 28, and a disc drive matrix 30. The disc drive matrix 30 includes a plurality of disc drives 32, each having an array supporting drive controller 34. The array controller 24 is coupled to drives 62, 64, 66 through two Fibre Channel interfaces 68, 70 (col. 8, lines 13-15). **Anderson** only includes fiber channel disk drives, but no serial disk drive or any interface connection device that converts a serial interface to a fiber channel interface. As such, **Anderson** does not include "two types of disk drive, which are a fiber channel disk drive with a fiber channel interface, and a serial disk drive with a serial interface" or "the serial disk drive is connected to the fiber channel cable via an interface connection device that converts the serial interface to a fiber channel interface" or a "controller discriminates the type of each of the disk drives by communicating via the fiber channel cable" as recited in claims 1 and 13. **Anderson** neither include "a serial disk drive enclosure that comprises: a plurality of serial disk drives" or "a plurality of interface connection devices which collects information on the disk drive connected to the serial disk drive enclosure; judges whether the disk drive connected to the serial disk drive enclosure is a serial disk drive; and, when the disk drive connected to the serial disk drive enclosure is a serial disk drive, reports the fact that the disk drive connected to the serial

disk drive enclosure is a serial disk drive to the controller by using the fiber channel loops” or a “controller registers the fact that the disk drive connected to the serial disk drive enclosure is a serial disk drive in the memory and manages the disk drive connected to the serial disk drive enclosure as a serial disk drive” as recited in claim 22.

U.S. Patent No. 6,829,658 B2 to **Beauchamp** et al. assigned to EMC Corporation is entitled *Compatible Signal-To-Pin Connector Assignments for Usage with Fibre Channel and Advanced Technology Attachment Disk Drives*. **Beauchamp**’s storage system 10 (Figs. 1 & 4) includes at least one rack 12 of storage devices or enclosures 14, 14’ (col. 1, lines 17-18). The enclosures 14, 14’ are connected to each other by cables 34, 34’ in a loop topology col. 1, lines 38-40). A Fibre Channel protocol provides an interface where host processors or servers communicate with the enclosures 14, 14’ and with disk modules 18 installed therewithin. The disk modules 18 can have Fibre Channel disk drives or serial advanced technology attachment (SATA) disk drives (col. 1, lines 49-55). An SATA disk drive 84 is electrically connected to a disk drive connector 90 attached to one side of an adapter board 88 (Figs. 3-4). The adapter board 88 makes an ATA disk module 82 (Fig. 3) physically and electrically compatible with a Fibre Channel disk module (col. 2, lines 5-6; col. 5, lines 10-18). When the ATA disk drive 84 is installed in an ATA enclosure, an identification signal operates to notify a controller 104 that the disk drive 84 has been placed in an appropriate type of enclosure (col. 6, lines 46-50). If the ATA disk module 82 is mistakenly plugged into a midplane connector 62 within an FC enclosure 50, the controller 104 determines (step 212) whether the adapter board 88 is in electrical communication with a compatible control card ATA BCC 92 or with an incompatible control card FC LCC 58. If the control card is incompatible with the ATA disk drive 84, the controller 104 asserts (step 216) grant signals GNT_A_N and GNT_B_N on contacts 1 and 11 of a midplane connector 100. Both FC LCCs 58, 58’ then bypass (step 224) the ATA disk module 82 in the FC loop. An incompatible ATA disk drive 84 is effectively removed from the FC loop (Figs. 6-7; col. 8, lines 23-25, 40-43, 49-52 and 58-62). **Beauchamp**’s controller 104 discriminates the types of FC and ATA disk drives only by determining whether they are physically and electrically compatible with a relevant disk module, but not by communicating via the fiber channel cable. As such, **Beauchamp** does not provide a “controller discriminates the type of each of the disk drives by communicating via the fiber channel cable” as recited in claims 1 and 13. **Beauchamp** neither include “a plurality of interface connection devices which

... reports the fact that the disk drive connected to the serial disk drive enclosure is a serial disk drive to the controller by using the fiber channel loops” as recited in claim 22.

U.S. Pat. App. Pub. Nos. 2004/0162940 A1 and 2005/0071525 A1 of **Yagisawa** et al. is entitled *Storage System*. **Yagisawa**’s disk array 700’ (Figs. 1-2) includes an FC drive chassis 300 for storing FC disk group 310 and an ATA drive chassis 400 for storing ATA disk drive group 410. the FC drive chassis 300 and the ATA drive chassis 400 are connected to each other by a FC loop 600, i.e., a fibre cable (Fig. 7; [0093] of the App. ‘940). The ATA disk devices 401 stored in ATA drive chassis 400 cannot be connected directly to the FC loop 600. The ATA drive chassis 400 includes an FC-ATA conversion I/F 430 for converting conversion between the FC interface and the ATA interface ([0094] of the App. ‘940). Upon receiving a command to write data from a host 100, the disk array control unit 200’ executes a drive command issuance program 220 and determines a command to be issued to a disk device ([0091] of the App. ‘940). The disk array control unit 200’ refers to the “drive type” in a col. 240b of a drive management table 240 (Fig. 2; [0049] of the App. ‘940), and determines whether issuance destination of the command is an FC disk device 301 or an ATA disk device 401. However, **Yagisawa**’s ATA disk drive group is connected as parallel (PATA; Figs. 1 & 7), rather than serial (SATA: a serial link transmits a single stream of data). Note: Fig. 8 depicts a port bypass circuit 330 for the connection of the FC disks 301, but not the ATA disk devices 401. As such, **Yagisawa** does not include “two types of disk drive, which are a fiber channel disk drive with a fiber channel interface, and a serial disk drive with a serial interface” or “the serial disk drive is connected to the fiber channel cable via an interface connection device that converts the serial interface to a fiber channel interface” or a “controller discriminates the type of each of the disk drives by communicating via the fiber channel cable” as recited in claims 1 and 13. **Yagisawa** neither include “a serial disk drive enclosure that comprises: a plurality of serial disk drives” or “a plurality of interface connection devices which collects information on the disk drive connected to the serial disk drive enclosure; judges whether the disk drive connected to the serial disk drive enclosure is a serial disk drive; and, when the disk drive connected to the serial disk drive enclosure is a serial disk drive, reports the fact that the disk drive connected to the serial disk drive enclosure is a serial disk drive to the controller by using the fiber channel loops” or a “controller registers the fact that the disk drive connected to the serial disk drive enclosure is a

serial disk drive in the memory and manages the disk drive connected to the serial disk drive enclosure as a serial disk drive” as recited in claim 22.

Conclusion

Based on the results of the comprehensive prior art search as discussed above, Applicants contend that the disk array device as recited in independent claims 1 and 22, especially the feature of “controller discriminates the type of each of the disk drives by communicating via the fiber channel cable” and “a plurality of interface connection devices which ... reports the fact that the disk drive connected to the serial disk drive enclosure is a serial disk drive to the controller by using the fiber channel loops” are patentably distinct from the cited prior art references.

In particular, as now recited in the claim 1 (for example, the embodiment shown in Fig. 4), the disk array device comprises: a disk array device enclosure 200; a plurality of disk drives 220 stored in the disk array device enclosure 200; a controller 310, which controls the reading and writing of data from and to the disk drives 220; and a fiber channel cable connecting the disk drives 220 and the controller 310. The disk drives 220 include two types of disk drive, which are a fiber channel disk drive 220F with a fiber channel interface, and a serial disk drive 220S with a serial interface. The serial disk drive 220S is connected to the fiber channel cable via an interface connection device that converts the serial interface to a fiber channel interface. The controller 310 discriminates the type of each of the disk drives 220 by communicating via the fiber channel cable.

Claim 13 is a management method for the disk array device recited in claim 1.

The invention (for example, the embodiment shown in Figs. 1 & 8), as recited in claim 22, is also directed a disk array device, comprising: a controller enclosure 300 that comprises: a communication control unit that is connected to a host device HC and receives data from the host device HC; cache memory 313 that is connected to the communication control unit and stores data exchanged between the communication control unit and the host device HC; a plurality of controllers 310 that is connected to the host device HC and the cache memory 313 and performs control so that data exchanged between the host device HC and the cache memory 313 is transferred to the communication control unit or received from the communication control unit; information storage memory 314 that saves information managed by the plurality of controllers

310; and a plurality of drive interfaces 315 that transfers data, which is received by the host device HC, under the control of the plurality of controllers 310; and a serial disk drive enclosure 200B[1] (Fig. 8) that comprises: a plurality of fiber channel loops connected to the plurality of drive interfaces 315 in the controller enclosure 300; a plurality of switching circuits that is connected to the plurality of fiber channel loops and that is used to switch the connection between the controller enclosure 300 and the serial disk drive enclosure 200B[1]; a plurality of interface connection devices that is connected to the plurality of controllers 310 by means of the plurality of fiber channel loops and that is connected to a fiber channel interface used by the plurality of fiber channel loops and to a serial disk drive interface; a plurality of dual-port switching devices that is connected to the plurality of interface connection devices and that controls switching to receive data from the plurality of interface connection devices; a plurality of serial disk drives 220S that is connected to the plurality of dual-port switching devices and that stores data transferred by means of the drive interface by receiving this data via the fiber channel loops, the switching circuits, the interface connection devices and the dual-port switching devices; and an enclosure management processor that monitors the operation of the interface connection devices. The plurality of interface connection devices collects information on the disk drive connected to the serial disk drive enclosure 200B[1]; judges whether the disk drive connected to the serial disk drive enclosure is a serial disk drive; and, when the disk drive connected to the serial disk drive enclosure 200B[1] is a serial disk drive, reports the fact that the disk drive connected to the serial disk drive enclosure is a serial disk drive to the controller 310 by using the fiber channel loops. The controller 310 registers the fact that the disk drive connected to the serial disk drive enclosure 200B[1] is a serial disk drive in the memory and manages the disk drive connected to the serial disk drive enclosure as a serial disk drive.

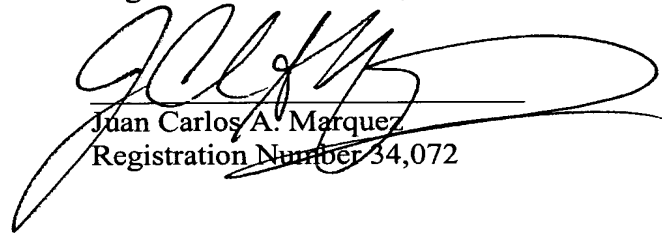
In view of all the above, clear and distinct differences as discussed exist between the present invention as now claimed and the prior art references, Applicants respectfully contend that the prior art references cannot anticipate the present invention or render the present invention obvious. Rather, the present invention as a whole is distinguishable, and thereby allowable over the prior art.

Favorable consideration of this application is respectfully solicited. Should there be any outstanding issues requiring discussion that would further the prosecution and allowance of the

above-captioned application, the Examiner is invited to contact the Applicants' undersigned representative at the address and phone number indicated below.

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